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TWO NEW FAMILIES AND OTHER NORTH AMERICAN
DIPLOPODA OF THE SUBORDER CHORDEUMIDEA

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The material on which this paper is based has been accumulating for many years. Following a recent examination of it, showing that two new families are involved, one typified by a recognized genus, the other undescribed, I thought it desirable to publish the information, as well as that concerning other species of the suborder represented in the collection. All specimens have been deposited in the U. S. National Museum.

Apterouridae, new family

Type-genus: *Apterourus*, new genus.

Diagnosis: Related to the Tingupidae but distinguished by the granular to smooth metazonites having large macrosetae; lateral keels not present beyond segment 24, thin, and nearly horizontal; gonopods formed from eighth legs only; ninth legs essentially like those that follow.

Description: Body small, strongly chitinized, and composed of 30 segments; macrosetae long and stout.

Head scarcely wider than segment 1 and not covered by it; antennae moderately short and crassate; ocelli in several series; gnathochilarium with a promentum.

Segment 1 nearly as wide as segment 2 and with projecting outer angles. Segments 2-24 with broad, thin, horizontally projecting lateral keels gradually reduced in size caudally and absent behind segment 24; keeled metazonites densely granular. Last segment rounded-truncate at apex, sides oblique. Anal valves squarely angular at dorsoposterior limit.

Gonopods formed from eighth pair of legs only, and with stout flagella. Ninth legs similar to those that follow except having somewhat lobed coxae; legs thereafter normal except coxae of eleventh legs are perforate. Legs in front of gonopods not modified except that some are slightly more crassate than others.

Apterourus, new genus

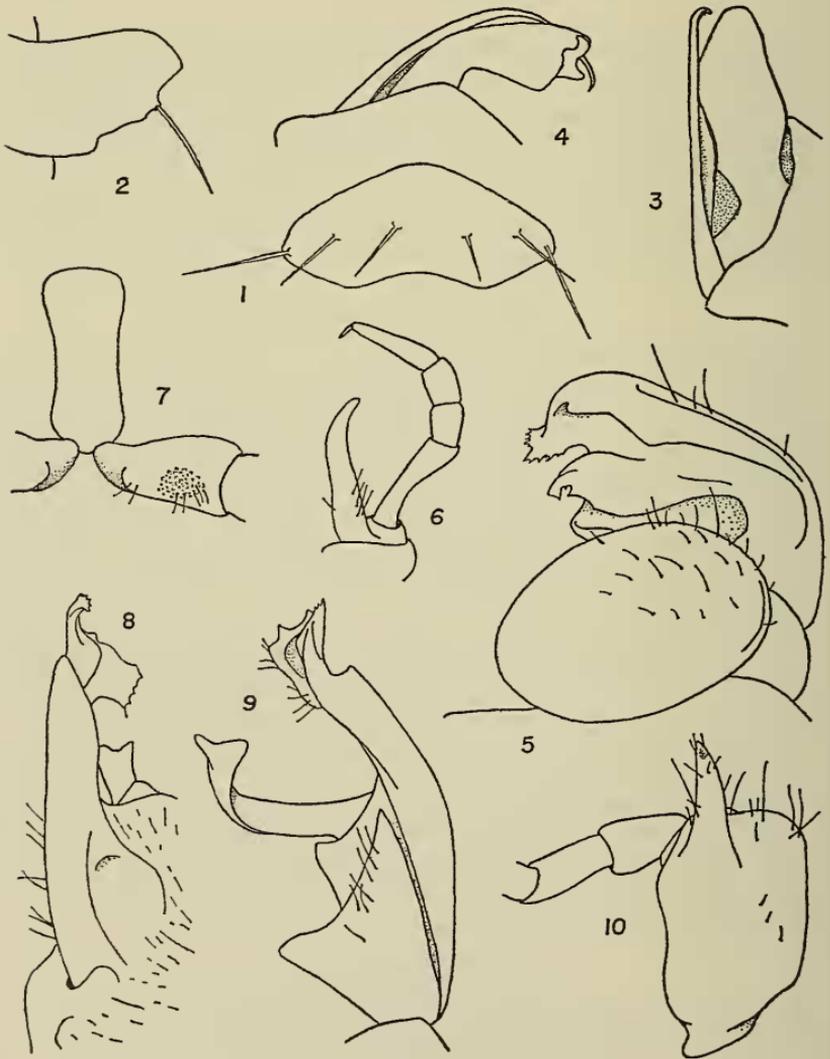
Etymology: Greek, *apteros*, wingless + *oura*, tail; (masculine).

Type-species: *Apterourus horizontalis*, new species.

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Description: In addition to family characters, the head densely setose with setae decreasing in length from in front to crest of vertex, behind which it is smooth; no vertical sulcus. Antennae with joints 3 and 5 equal in length but 5 twice as thick as 3.

Segment 1 with lateral angles projecting almost horizontally; macrosetae crossing middle in an almost straight line. Segments thereafter with prozonites descending abruptly to broad constriction from which densely granular, keeled metazonites rise rapidly; posterior margin of



metazonites thin. Lateral keels broad, nearly horizontal, thin, and concave above; outer margin very oblique and irregular, the large outer seta projecting caudoectad from near its middle.

Gonopods simple, caudally directed; apices extending between ninth legs which resemble those that follow except in having lobed coxae and a wide sternum; tenth and eleventh legs with narrowing sterna.

Apterourus horizontalis, new species
(Figs. 1-4)

Holotype: Male, USNM myriapod collection no. 3159.

Type locality: Holotype, another male, immature male, 2 females, from Cajon Pass, 7 mi. W of Cajon, on Big Pine Road, San Bernardino Co., California, 14 February 1929, O. F. Cook.

Description: Largest male 7 mm long, largest female 8 mm; color in alcohol dark brown.

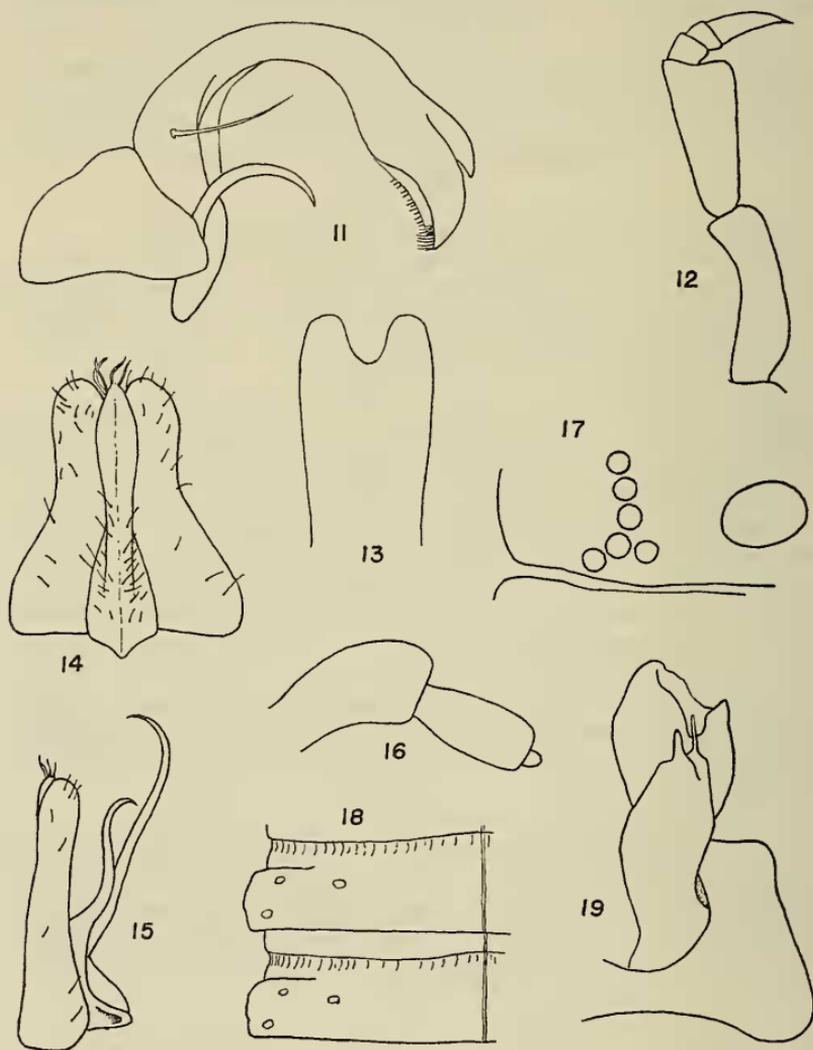
Segment 1 shown in Fig. 1, the outer limits projecting, thickened, and keel-like; surface coarsely granular, like that of keeled metazonites; granules decreasing as keels decrease in size; keelless metazonites smooth.

On following segments the thin, dorsally concave, lateral keels project widely and almost horizontally and are shaped as in Fig. 2, their size gradually decreasing to mid-body but more rapidly thereafter to segment 24, behind which they are lacking; keels of segments 2-5 bent forward, others directed outward; seta on each keel larger than setae on body which rise upward and forward on keeled segments but somewhat caudally on keelless ones. Prozonites coarsely reticulated, suddenly descending to a broad, nearly flat, interzonal constriction containing finer reticulations; convex metazonites rising rapidly from constrictions and with posterior margins long, thin, and with dorsal granules slightly projecting.

Gonopod shown in Figs. 3 and 4, developed from eighth leg only and having stout flagellum. Legs in front of gonopods normal except for the slightly swollen third pair. Ninth legs similar to others except for a distomesal tubercle on each coxa and in having a wide sternum; sterna of legs 10 and 11 narrowing, others normal; pores opening from distomesal face of coxae of eleventh legs.

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FIGS. 1-4. *Apterourus horizontalis*, new species. 1, segment 1; 2, keel of segment 3; 3, right gonopod, ventral view; 4, right gonopod beyond side of segment, lateral view. FIGS. 5-7. *Caseya coxalis*, new species. 5, left gonopod and ninth leg, lateral view; 6, second leg of male, posterior view; 7, seventh leg of male, posterior view. FIGS. 8-10. *Cleidogona australis*, new species. 8, left gonopod, ventral view; 9, left gonopod, lateral view; 10, twelfth coxal joint and sternal peg of male, ventral view.



FIGS. 11-13. *Costaricia curvipes*, new species. 11, right gonopod, lateral view; 12, ninth male leg, posterior view; 13, lamina of twelfth male legs. FIGS. 14-16. *Tingupa arizonica*, new species. 14, gonopods, ventral view; 15, right gonopod, lateral view; 16, ninth male leg, posterior view. FIGS. 17-19. *Flagellopetalum quadratum*, new species. 17, side of head with antennal socket and ocelli; 18, left half of segments 9 and 10 with body rolled slightly to right; 19, right gonopod, anterior view.

Family CASEYIDAE

Caseya coxalis, new species

(Figs. 5-7)

Holotype: Male, USNM myriapod collection no. 3160.

Type-locality: Holotype, 2 males, 4 females, numerous young, Davenport, Santa Cruz Co., California, 21 February 1929, O. F. Cook.

Paratype localities: Male, 3 females, Santa Cruz Mts., between Santa Cruz and Holy City, Santa Cruz Co., 2 January 1928; male, female, S of Pescadero, San Mateo Co., California, 21 February 1929, O. F. Cook.

Diagnosis: Closely related to *C. similis* Causey but anterior gonopods broader and irregularly serrate at apex; large outer joint of ninth legs rimmed for a short distance in front; and coxal processes of male legs 2 and 7 longer and more slender.

Description: Length 15-16 mm, females stouter than males; body with median light band, usually quite narrow but in some specimens wide enough to include upper seta on each side. First 4 or 5 segments lacking striae above lower seta; on succeeding segments number of striae increases from 1 to 3 or 4 above the seta but they are fainter than striae below it.

Gonopod shown in Fig. 5; outer joint of ninth leg more convex than in *C. heteropus* Cook and Collins, and rimmed for only a short distance in front; coxal joint not bifid but elevated into a heavy fungiform lobe; basal portion stemlike, with a small mesal tubercle; outer portion expanded, ending in a caudally produced truncate triangle with surface deeply concave. Second pair of male legs smaller and more slender than first or third pair; coxal joint with a longer, more slender, more curved lobe than in either *similis* or *heteropus* (Fig. 6). Third leg with coxal process a little longer and more acuminate than in *heteropus*. Seventh coxae enlarged as in *heteropus* but each posterior lobe long and acute (Fig. 7). Inner processes of tenth coxae much as shown in illustration for *heteropus* but outer distal limit of each swollen into a large, thick, rounded, and laterally conspicuous projection.

Caseya dynotypa Chamberlin

This species was based on a single female with a very brief, unsatisfactory description mentioning only length and coloration but no structural character. It has not been reported again and probably can be identified only through future study of topotype material. References to the species in the Checklist of the Millipeds of North America are misspelled *dynopta*.

Caseya similis Causey

Male from Woodford, N of Tehachipi, California, 8 January 1928, O. F. Cook.

Not having seen a specimen of *C. heteropus*, and basing her comparison on its illustrations, Causey stated that the ninth legs of *similis*

were like those of *heteropus*, whereas *heteropus* has the outer joint of this leg nearly encircled by a raised rim. *C. similis* has no rim and the surface of the joint is more convex. Second male legs not smaller than first or third pair.

Family CLEIDOGONIDAE

Cleidogona australis, new species

(Figs. 8-10)

Holotype: Male, USNM myriapod collection no. 3161.

Type-locality: Holotype and another male, Highlands Hammock State Park, Sebring, Florida, 28 November 1963, E. M. Loomis.

Diagnosis: Most closely related to *C. hadena* Causey but apex of each anterior gonopod is not finely setose along inner margin and is of different shape; coxae of legs 10 and 11 lacking protuberances present in *hadena*.

Description: Holotype 14 mm long, paratype 12 mm long.

Antennae very slender; joint 6 as long as 7, thickest at middle where it equals or exceeds thickness of any inner joint. Ocelli in 6 or 7 rows, 6-5-4-4-3-2-1 beginning near antenna of paratype, 6-5-5-4-3-1 in holotype.

Gonopods (Figs. 8, 9) most closely resembling those of *C. hadena*, but showing numerous minor differences. Joint 2 of male legs 3 and 4 more compressed from front to back than in legs following. Coxae of seventh legs much thicker than anterior ones, most of ventrally exposed face of each coxa occupied by a large, spongy or finely granular area; a small rounded tubercle present behind, near mesodistal corner. Ninth legs with basal joint in a long sigmoid curve, otherwise not unusual. Tenth legs widely separated by the long flattened sternum which has its median two-thirds increasingly raised into a broad elevation, high and strongly produced behind; next sternum narrower, shorter, and more depressed; twelfth sternum with process, shown in Fig. 10, extending forward beneath the more or less crossed coxal lobes of legs 10 and 11, the lobes subcylindrical and three times as long as broad; coxae lacking other processes mentioned for *hadena* but each with a granular area similar to that shown in Fig. 10 for twelfth coxa.

Costaricia, new genus

Type-species: *Costaricia curvipes*, new species.

Description: Although its range is far south of that of *Cleidogona*, it has many of the characters of that genus and is closely related to it. It is considerably smaller, but the gonopods present the best differences, the principal branch of each being simple, very strongly curved caudad, with apex somewhat expanded; secondary branch a rather small, attenuated, evenly curved hook. Secondary sex characters of male legs, including ninth pair, essentially those of *Cleidogona*, but lamina of twelfth legs larger than most species of that genus, and it is apically divided, thus unmistakably differentiating the two genera.

Costaricia curvipes, new species
(Figs. 11-13)

Holotype: Male, USNM myriapod collection no. 3162.

Type-locality: Holotype, 23 February 1937; female, 21 February 1937; male, March 1937, Cairo, Limon Prov., Costa Rica, H. F. Loomis.

Description: Length 10 mm; ocelli in rows paralleling lower side of head, 6-5-4-4-3-2-1, thus forming a triangular cluster.

Gonopod shown in Fig. 11. Legs if front of gonopods without secondary modifications, the first two pairs only slightly smaller than those that follow and these not noticeably crassate. Ninth leg (Fig. 12) with second joint thickest at outer and instead of near middle, as in *Cleidogona*. Coxae of legs 10 and 11 with long inflated processes, sterna between legs 9, 10, and 11 wide; sternum between twelfth legs narrow, coxae almost touching; lamina in front of twelfth legs rather thick, curving up and forward, apex bifid as seen in Fig. 13.

Family RHISCOSOMIDIDAE

Rhiscosomides sp.

Female from Santa Cruz Mts., between Santa Cruz and Holy City, California, 2 January 1928, O. F. Cook.

This female probably represents an undescribed species as it is only 6 mm long, as well as being found over 400 mi. south of the previously most southern record for the genus. It is mentioned to invite collectors to search for specimens in the area.

Tingupidae, new family

Type-genus: *Tingupa* Chamberlin.

Type-species: *Tingupa utahensis* Chamberlin.

Although I originally placed *Tingupa* in the Rhiscosomididae (Bull. Mus. Comp. Zool., 92:387, 1943), a comparison of *Tingupa arizonica*, new species, with a syntype of *Rhiscosomides meineri*, kindly sent me by Prof. Silvestri, its describer, indicates that this disposition was in error and, furthermore, that a separate family is needed for it, the only included genus, now consisting of four species and an additional subspecies. The genus runs to couplet 7 of the Key to North American families of Chordeumidea, p. 85 in the Checklist of the Millipeds of North America, the key here revised from that point to include the new families Tingupidae and Apterouridae.

Supplemental key to North American families of Chordeumidea

- 1A. Dorsum densely short-setose in addition to macrosetae and other sculpturing; segment 1 enlarged, much wider than head, anterior margin transverse and triarcuate; outer macroseta each side well within lateral limits; last segment short and broadly rounded throughout behind Rhiscosomididae
- 1B. Dorsum never short-setose; segment 1 not wider than head, usually much narrower, anterior margin rounded or rounded-

- angular; outermost macroseta at lateral limit; last segment with sides oblique and nearly straight, apex truncate 2
- 2A. Gnathochilarium without a separate promentum Bactropidae
- 2B. Gnathochilarium with distinct mentum and promentum 3
- 3A. Size large, at least 14 mm long; body without strongly projecting lateral keels Cleidogonidae
- 3B. Size smaller, body 8 mm or less long, with prominent lateral keels 4
- 4A. Metazonites with dense scattering of thin, short, longitudinal carinae; macrosetae small; keels thick, following contour of dorsum, and evident to last two or three segments; ninth male legs 3-jointed Tingupidae
- 4B. Metazonites merely densely granular on keeled segments, smooth on others; macrosetae large; keels strongly projecting, almost horizontal, thin, and terminating on segment 23 or 24; ninth legs 6-jointed Apterouridae

In addition to the characters involved in the Checklist key and the above supplement, the Tingupidae have males with 28 or 30 segments; segment 1 with raised anterior rim, outer angles descending below general level; keels of succeeding segments strongly projecting, thick, almost knoblike, and each with a large depressed area behind, mesad of posterior corner, outer macroseta rising from this depression. Gonopods each composed of two rather simple, adjacent, elongate elements in front, and two long, slender, acuminate, posterior processes, one of which may be subdivided. Ninth male legs 3-jointed, basal joint long and heavy; outer joint small to rudimentary; claw absent in some species.

***Tingupa arizonica*, new species**
(Figs. 14-16)

Holotype: Male, USNM myriapod collection no. 3163.

Type-locality: Many males and females, Mt. Lemmon, elevation 8,000 ft., Santa Catalina Mts., Pima Co., Arizona, under leaves and bark of fallen pines, 30 May 1930, H. F. Loomis.

Paratype localities: Arizona: 25 specimens, type-locality, 23 April 1921; 9 males labelled only "probably Santa Rita Mts., Pima Co."; 15 specimens, both sexes, Mt. Graham, Graham Co., 9 October 1930; all above by H. F. Loomis.

Diagnosis: Readily distinguished from other species by the reduced number of segments of males, and the clawless, rudimentary third joint of ninth male legs.

Description: Sexes differing considerably in length, females reaching 8 mm, males only 6 mm and with number of segments reduced to 28. Living color uniform light brown with a pale grayish bloom that is lost in preservation, the brown darkening.

Head setose but otherwise smooth and shining, lacking ridges or a vertigial sulcus. Eyes of 10-17 ocelli in a subtriangular group with

anterior and lower sides nearly straight, posterior side concave with 5-7 ocelli. Antennae crassate; joint 5 a little longer than joint 3 and twice as thick. Gnathochilarium with several obvious differences from Chamberlin's figures for *utahensis* and *monterea*.

Segment 1 narrower than head and much narrower than segment 2; front margin bluntly angled at middle; either side nearly straight ecto-caudally to outer limits; entire margin with distinct raised rim; outer limits strongly and abruptly deflexed from a rather long, shoulderlike angulation of dorsal surface, most prominent at its posterior end, the outermost seta issuing from below the angulation with its base and the outer limit of segment not visible from above.

Segments with prozonites strongly convex, metazonites not at all; interzonal constriction broad and deep; lateral keels evident to segment 25 of males and to segment 27 of females.

Gonopods shown in Figs. 14 and 15. Ninth legs of male with joint 3 rudimentary and lacking claw (Fig. 16).

Family TRICHOPETALIDAE

Flagellopetalum quadratum, new species

(Figs. 17-19)

Holotype: Male, USNM myriapod collection no. 3164.

Type-locality: Sixteen males and females, mostly from beneath logs in comparatively dry deciduous woods, Glendale, Prince Georges Co., Maryland, 22 February 1916, H. F. Loomis.

Paratype locality: Male, Woodmoor, Prince Georges Co., Maryland, 16 February 1916, H. F. Loomis.

Diagnosis: Aside from material differences of the gonopods, this species is distinguished from *F. stannardi* Causey by being maculate with brown, rather than gray banded; lateral keels possibly projecting farther and more angular at their posterior corner.

Description: Length 4.3-5 mm, females slightly larger than males. Living color brownish and white; vertex and front of head brownish with many white patches; anterior segments maculate with brown that becomes lighter on posterior segments, last segments being white; on colored segments a large white spot behind each inner seta. In alcohol the specimens become brown.

Head with 4-7 ocelli usually in a single curving row but when there are 6-7 ocelli the sixth and seventh are located in front as seen in Fig. 17. Antennae rather crassate; joint 3 longer but considerably more slender than joint 5.

Segment 1 with a raised rim along front margin, rim thickest on outer angle. Succeeding segments with metazonites smooth and shining above, longitudinally striate on sides below keels. Lateral keels strongly projecting and continuing to antepenultimate segment; anterior corners rounded, posterior ones almost squarely angled as shown in Fig. 18. In both species of this genus the two outer

setae on each side are on the lateral keels, the inner seta adjacent but on the body, far removed from median line. Anal valves smooth with inner margins finely rimmed.

Gonopod shown in Fig. 19; ninth legs of male essentially like those of *stannardi*; fourth joint of sixth leg with a swelling, as in that species.